

DSTL RADSAFE EXERCISE

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ABSTRACT

RADSAFE is a UK mutual support company which provides an emergency response in the event of a road/rail transport accident involving radioactive materials belonging to a company member. DSTL (Defence Science and Technology Laboratory) forms part of the emergency response cover on behalf of the Ministry of Defence membership.

As part of its obligations as a RADSAFE member, DSTL undertook an exercise on its Porton Down Range in Wiltshire in December 2009. The aim was to test its RADSAFE 'Level 2' response to a road traffic accident involving radioactive material. This paper describes the exercise, including how it was organised and implemented.

Good communications and decision-making are of vital importance in emergency situations. An essential part of the exercise was the interaction of DSTL's responders with the emergency services, particularly the Fire and Rescue Service. Information exchange with the owner of the package involved was also a key element. Real radioactive sources were used to inject some realism into the scenario.

The exercise was a successful demonstration of DSTL's ability to respond to a transport accident. Valuable lessons were learned, in terms of both exercise organisation and emergency response.

INTRODUCTION

DSTL is the Radiation Protection Adviser for the UK Ministry of Defence (MOD). An important part of its role is to provide support to the MOD to enable it to meet its radiation safety responsibilities during planned and unplanned events, under peacetime conditions or on military operations. As regards unplanned radiological events, nuclear and non-nuclear, DSTL supports up to 20 emergency plans and operations, including RADSAFE.

IAEA and UK national regulations (References 1 and 2) require consignors of radioactive materials to have in place emergency response arrangements for the event of a transport incident. RADSAFE fulfills this requirement for its members.

RADSAFE provides a guaranteed response to an incident, ensuring swift radiation protection advice and support to the emergency services. This is on a UK-wide, 24-hour basis. The response has three levels:

- Level 1: The Civil Nuclear Constabulary's Constabulary Communications Centre (CCC) receives notification of an incident, usually from the police, via the RADSAFE emergency telephone number. The CCC provides generic radiological protection advice and alerts the Level 2 and Level 3 responders.
- Level 2: The RADSAFE member nearest to the incident (the Level 2 responder) provides radiological protection advice, by telephone, to the emergency services and attends the scene (nominally within 2 hours) to provide further advice and support.
- Level 3: The consignment owner (the Level 3 responder) provides specific advice to the Level 2 responder and the emergency services and attends the scene to retrieve the consignment and carry out any remediation necessary.

DSTL does not currently consign radioactive materials and therefore would not expect to have a Level 3 role. However, it could be requested to respond to an incident at Level 2.

AIM AND OBJECTIVES OF THE EXERCISE

The aim of the exercise was to test DSTL's RADSAFE Level 2 response to a road traffic accident involving radioactive material.

The exercise had a number of specific objectives, i.e. to test:

- The notification procedure.
- Internal and external communications.
- Procedures and responses, including information management and decision making.
- Specialists in their roles.
- Interfaces with other agencies, particularly the emergency services.
- Support to the recovery phase.

In addition, although not a specific objective of the exercise, the opportunity was provided for a consignor organisation to demonstrate its Level 3 response.

PREPARATION

Early Planning: 4 - 6 months before exercise

During June and July 2009, the exercise scenario, objectives and success criteria were formulated. Agreement to take part in the exercise was obtained from the CCC, Wiltshire Police, Wiltshire Fire & Rescue Service (WFRS), Hampshire Fire & Rescue Service (HFRS) and the Ambulance Service. Another RADSAFE member agreed to act as the consignment owner, with the incentive of being able to use the exercise to test their Level 3 response.

It was identified that DSTL's Porton Down Range in Wiltshire, normally used by the military for training exercises, would be an ideal venue for the exercise. It is a secure site with no public access, covering a large area (7500 acres) generally away from public view. Furthermore, it was already

cleared for controlled use of radioactive sources and the range staff were trained for such work. A date of December 1st was set for the exercise.

Planning: 1 - 4 months before exercise

During this period, there was, not surprisingly, a great deal of liaison with the external participants and Porton's range staff, involving many discussions and meetings.

An initial planning meeting, involving all parties, took place in mid-August. There was some refinement of the scenario in light of the input from this meeting. The range staff agreed to obtain suitable vehicles for the accident scene.

Much of the technical planning also took place in this period. The exercise consignor agreed to supply packages and material to simulate a typical consignment. It was decided that Americium 241 smoke detectors would provide a suitable representation of the exercise radioactive material – the naval base at Portsmouth agreed to lend a number of ex-ship detectors for this purpose (Minerva F36 smoke detectors, each incorporating 2.2 MBq of Americium 241 (significantly greater than domestic detectors)).

A radiological risk assessment, and corresponding Local Rules, were written for the conduct of the exercise. Note that a generic health and safety risk assessment already existed for exercises on the range.

The planning anticipated that there would be approximately 30 observers, 30 – 40 participants and a small number of range staff, directing staff and assessors.

Planning: the month leading up to the exercise

The month leading up to the exercise was a period of intense preparatory and liaison work.

The second, and final, planning meeting for all parties took place three weeks before the exercise. Wiltshire Police agreed to supply two 'casualties'. Range security and access arrangements were finalised. Shelter and catering arrangements for observers and catering arrangements for participants were also finalised.

Further technical preparation took place. The exercise consignor delivered the agreed packages and material. The Americium 241 smoke detectors were transported to Porton for storage prior to the exercise. The responses of DSTL and FRS instruments to the smoke detectors were measured, for the information of the directing staff. The consignor also supplied expected dose rate and contamination levels for the scenario, again for directing staff purposes.

Safety documentation, i.e. the generic health and safety risk assessment and the radiological Local Rules, was supplied to all participants for pre-exercise reading, in order to facilitate sign-up on the day of the exercise. An unusual aspect was that this documentation did not identify the radionuclide being used. It was felt necessary to deny this knowledge to the participants in order to avoid giving clues as to the nature of the exercise (however, the radiological risk assessment, not supplied to the participants, did identify the radionuclide). This was covered in the Local Rules by emphasising that the exercise would be closely supervised by the directing and range staff.

Unfortunately, in the week prior to the exercise, WFRS, because of other commitments, had to withdraw much of the support they had intended to give. Some rapid revision of the planned scenario was necessary, to account for the fact that a significant number of the WFRS personnel were now having to be simulated.

Preparation Immediately Prior to the Exercise

The day before the exercise, a written briefing was given to the CCC. This contained information on how the exercise RADSAFE alert was to be instigated, including telephone numbers specific to the exercise.

The range staff set up the accident scene, having drained the accident vehicles of all fuel and oils. Immediately before the exercise started, the Americium 241 smoke detectors were placed amongst

the spilled material. Note that the smoke detectors had been sealed in polythene, to protect them from the elements and to prevent the potential for spread of contamination.

DESCRIPTION OF THE EXERCISE

Background

The exercise took place on December 1st 2009 and was run by two DSTL personnel acting as directing staff. They and an additional DSTL staff member carried out the assessment.

Throughout, directing staff involvement was kept to a minimum in order to allow events to unfold as naturally as possible. Most of the information injected by the directing staff consisted of instrument readings.

The accident scene was set up on a road on the Porton Down Range, to simulate a road traffic accident on a bend on a rural Wiltshire road, as follows:

A van has collided with a car. The van was carrying two metal containers (similar to oil drums), which contained radioactive waste (soft waste – gloves, coveralls, etc - contaminated with plutonium). The van has turned over onto its side. One drum has been thrown out through the rear doors, the lid coming loose so that some of the contents have spilled out. The other drum remains on the van, undamaged. There has been no fire. There are no hazardous chemicals present and no criticality hazard. There are two (semi-conscious, dazed) casualties in the car and one walking wounded (the van driver).

Notification and Initial Communications

The van driver raised the alarm by calling the CCC, who instigated a RADSAFE callout shortly after 09.00 to Wiltshire Police and the RADSAFE responders. DSTL Alverstoke (the MOD's Radiation Protection Adviser, based at Alverstoke near Portsmouth) acted as the Level 2 responder, with the package consignor acting as the Level 3 responder. Wiltshire Police alerted WFRS.

The DSTL response team consisted of two personnel: a Duty Health Physicist (DHP) and an Environmental Monitor (EM). The DHP received the following information from the CCC:

- Location and details of accident (casualties with minor injuries, etc).
- Two drum containers in van (White I, SCO (Surface Contaminated Objects), Plutonium 239 – 1.36 and 2.0 MBq); one drum is damaged.
- Contact telephone numbers for Wiltshire Police and the consignor.

DHP contacted Wiltshire Police (control room) and advised an estimated time of arrival at the accident scene. The DHP advised that the cordon distance should be a minimum of 45m, responders should stay upwind where possible and fire crews should wear Breathing Apparatus (BA) when approaching the vehicles.

On-scene Response (Level 2)

Wiltshire Police and WFRS attended the scene. The police set up an outer cordon on the approach roads at 100m and WFRS set up inner at 50m. WFRS took the role of lead emergency organisation, including that of IC (Incident Commander).

Communications links were established between the emergency services at the scene, the DSTL response team and the consignor. The DSTL response team was still en-route (note: in reality, the team was at a holding area on the Porton site). During this period they received confirmation of the consignment details from the consignor, who advised that the radioactive contamination should be assumed to be loose and that the beta-gamma dose rate on the outside of the undamaged packages was less than 2 μ Sv/hr. The consignor also confirmed that there were no hazards other than radiological. DSTL advised the WFRS IC:

- Material is an alpha emitter, with some X-ray emissions.

- Use of BA, protection suits, paper coveralls (for casualties) and Electronic Personal Dosemeters (EPDs) is appropriate.
- Assume accident scene and casualties are contaminated.
- Any symptoms exhibited by casualties are unlikely to be related to exposure to radioactive material.
- Do not attempt to remove any material from the scene.

The HFRS Hazmat (Hazardous Materials) Team also attended, as they would for a real incident in Wiltshire (the Hazmat Team is a resource shared with WFRS).

Fire crew, wearing BA and protection suits, entered the inner cordon and assisted the two casualties from the car to a position upwind (but still inside the inner cordon).

The DSTL team arrived at the scene and had a briefing meeting with the WFRS IC and representatives of the Hazmat Team and the Ambulance Service. The DHP advised that the lack of response from FRS hand-held radiation meters was likely due to their inability to detect the low-energy emissions from the material involved. The IC advised that there were currently five FRS crew in the cordon with the two casualties from the car. The FRS crew are using BA and have only 15 minutes of air left.

The DSTL team prepared to enter the inner cordon, putting on PPE (Personal Protective Equipment, i.e. coveralls, overboots, gloves and oral-nasal face masks). They entered the cordon and used alpha/beta probes to monitor the FRS crew and casualties for contamination. None was found on the casualties but some low-level contamination was detected on the FRS crew, who now removed their BA and suits and put on fresh coveralls (the contaminated suits were bagged in polythene). The DHP reassured the FRS crew that they were unlikely to have breathed in any contamination since they had been using BA. The fire crew and casualties were given clearance to exit the inner cordon and the ambulance crew removed the casualties to hospital (simulated).

An air sampler was set up 5m downwind of the accident vehicles. The damaged drum was identified as the one which had contained 1.36 MBq of radioactive material. A radiation and contamination survey was carried out of the drum, the spilled contents and the area around the vehicles, using an alpha/beta probe and a doserate meter. Smear samples were also taken, and monitored away from the accident area using the alpha/beta probe. The extent of the contaminated area was established and a clean entry/exit route identified. The DSTL team then exited the inner cordon. The air sample was subsequently analysed and the results indicated that no airborne contamination was present.

The DHP briefed the IC and advised that the DSTL team had done as much as they could in terms of the Level 2 response.

On-scene Response (Level 3)

The consignor's response team arrived and were briefed by the IC and the DHP (who detailed the level and extent of contamination found).

It should be noted that the consignor's involvement was purely for demonstration purposes and was not part of the assessed exercise. The Americium 241 smoke detectors were removed by the directing staff immediately prior to this phase.

Members of the consignor's response team, wearing appropriate PPE, entered the inner cordon and retrieved the radioactive material and associated containers (the damaged drum was repacked and placed in an overpack). They then carried out a detailed survey of the vehicles and surrounding area to identify areas requiring decontamination. Contaminated areas of the vehicles and road tarmac were sprayed with a tie-down coating (simulated with water). Other areas were identified for turf removal. The stated intention was to remove the tie-down coating and contaminated turf and then re-survey for residual contamination.

The exercise was brought to an end at this point.

ASSESSMENT

The assessment of the exercise is presented below. The comments are almost entirely concerned with DSTL's response in the exercise, since testing this was the main aim.

Notification and Initial Communications

Notification and initial contacts (between responders) were made in a timely manner. Provision of information (details of accident/packages and phone numbers of other responders) by the CCC was accurate. DSTL provided appropriate initial advice to Wiltshire Police and WFRS. During all communications, the information relayed was confirmed.

Interfaces

Good communications between all parties were maintained throughout, both by mobile phone and face-to-face.

There was a good initial briefing meeting at the accident scene between DSTL and the emergency services. This was followed by update briefings throughout and a good rapport was built up between DSTL and the WFRS IC. The consignor's response team was fully briefed by DSTL on arrival and a good handover took place.

At all stages, there was accurate and timely information exchange between all parties and action plans were quickly agreed, with DSTL providing appropriate advice to the emergency services.

Teamworking

The DSTL responders worked well as a team. Generally, the EM took monitoring instrument readings whilst the DHP stayed outside the contaminated area, recording information. However, the DHP occasionally became too involved in monitoring tasks and this hampered the ability to make written notes and deal with mobile phone calls.

Recommendation: There should be clear demarcation between the DHP and EM roles. The EM should carry out monitoring of potentially contaminated areas. The DHP should maintain distance from such areas, in order to perform the other tasks and to maintain an overview of the situation.

Facilities and Equipment

DSTL used their Monitoring Land Rover as a response vehicle. However, this vehicle, being already fitted out for other types of response, does not lend itself well to easy access of cased equipment. Several equipment cases had to be opened on the road to the rear of the vehicle; this would not have been practical in adverse weather conditions.

DSTL's response procedure includes a specified list of equipment. Whilst this exceeds the RADSAFE requirement (Reference 3) in some areas, in both quantity and scope, it is clear that it is in need of revision. Some of the listed monitoring instruments are entering obsolescence to the extent that alternative instruments were used in preference to those listed. However, the instruments used were appropriate for the material being monitored and performed satisfactorily.

Recommendation: The Land Rover does not provide the best working space for a RADSAFE response. Future responders should consider using one of the DSTL vans as an alternative.

Recommendation: A full review and update of DSTL's RADSAFE response equipment should be carried out. Where necessary, instruments should be updated and additional equipment (e.g. spray paint to demarcate contaminated areas) included.

Competence of Level 2 Responders

The DSTL team provided a professional response, interacting well with the emergency services and the consignor (Level 3 responder). Their response and advice included consideration of: suitable

monitoring instruments, PPE, personal and area monitoring, casualty handling and information transfer. They demonstrated sufficient knowledge of the processes and equipment to meet the role of Level 2 responders (Reference 3). They correctly assessed the hazard and gave appropriate advice to the emergency services. The two criticisms detailed below almost certainly result from over-enthusiasm and exercise artificiality.

Although it was agreed with the consignor that it was only required to determine the extent of the contamination, some time was spent monitoring the vehicles and debris. Whilst necessary when undertaking a full survey, the benefit in this case is questioned, particularly given the nature of the known contaminant, the potential for resuspension and the imminent arrival of a fully equipped Level 3 response team.

The contamination monitoring of the FRS crew in the inner cordon was effective, with good explanations given. However, this was conducted very close to the accident vehicles and would have been better conducted well away from this area.

Recommendation: The need to avoid unnecessary risks should be further emphasised in training sessions (e.g. the detailed characterisation of contamination levels is more a responsibility of the Level 3 responder).

Recommendation: Care should be taken when choosing the location of clearance monitoring. This should be emphasised in training sessions.

Information Management

Information provided by the CCC and the consignor was quickly assimilated by the DSTL team, who correctly identified the nature of the hazard and advised the emergency services accordingly. They also made good use of their own monitoring information.

An auditable trail of information was created by the DHP, who made written notes of verbal communications, agreed actions and monitoring data.

TRAINING DAY

The exercise scenario was used to provide a training event for DSTL staff on the day following the exercise, since only two had taken part in it (to realistically represent DSTL's RADSAFE Level 2 response). The DSTL staff who took part in the training day had no knowledge of the scenario. The accident scene was as for the exercise, i.e. two crashed vehicles and damaged packaging, but no radioactive sources were used.

The training day was run by the two DSTL directing staff who had run the exercise – this enabled lessons learned during the exercise to be incorporated into the training. A Wiltshire Police officer and three FRS officers also took part, to simulate the presence of the emergency services. Six pairs of DSTL staff, all potential RADSAFE responders, were taken through the scenario in turn. This was done on an accelerated timescale (approximately one hour).

Each pair of responders was asked to start the process by providing advice, using information provided by the directing staff acting as the CCC, in a phone call to the lead FRS officer at the scene. They were then 'walked through' the scenario: 'arrival' at the scene, interfacing with the emergency services, cordon entry, monitoring of personnel and the accident scene for contamination and handover to the Level 3 responder. Throughout, advice was provided by the responders to the police and fire officers, who had been primed to closely question them.

The DSTL participants performed well and the emergency services' officers were complimentary about the quality of advice received. All the DSTL participants found the training day extremely useful, particularly by comparison to table-top exercises. A high value was placed on having a realistic accident scene and being able to interact with real members of the emergency services. Being questioned and pressurised by the emergency services, e.g. being asked for further information and clarification, was regarded as excellent preparation for a real event.

CONCLUSIONS

1. The exercise was a successful demonstration of DSTL's ability to respond to a transport accident involving radioactive material, meeting the aim of testing its RADSAFE Level 2 response. All the specific objectives were met.
2. Valuable lessons were learned and the consequent recommendations have been implemented and incorporated in DSTL's RADSAFE training.
3. The DSTL Porton Down Range proved to be an excellent facility for undertaking this type of exercise.
4. The use of radioactive sources added an extra element of realism to the scenario. This was appreciated by the emergency services, who rarely have the opportunity to work with real sources of radiation.
5. The training day which followed the exercise proved to be extremely useful to DSTL staff.

ACKNOWLEDGMENTS

The CCC, the emergency services (WFRS, HFRS, Wiltshire Police and the Ambulance Service) and the consignor organisation provided excellent and enthusiastic support to the exercise, all demonstrating a committed and highly professional response to the scenario.

REFERENCES

1. IAEA Safety Standards Series No. TS-R-1 – Regulations for the Safe Transport of Radioactive Material
2. The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (UK)
3. RADSAFE Responder Handbook (2007)